

Final Site Inspection Field Sampling Plan

**Lower Hackensack River Site
Bergen and Hudson Counties, New Jersey
Site ID No: NJN000201845**

Submitted to:

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ABBREVIATIONS AND ACRONYMS

CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal regulations
CTI	CTI and Associates, Inc.
DESA/CLP	Division of Environmental Service and Assessment/Contract Laboratory Program
DQCR	Daily Quality Control report
EDD	Electronic Data Deliverable
FSP	Field Sampling Plan
HASP	Health and Safety Plan
HMD	Hackensack Meadowlands District
HRS	Hazard Ranking System
KCD	Kansas City District
LHR	Lower Hackensack River
MLLW	Mean Lower Low Water
NCP	National Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
PA	Preliminary Assessment
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RM	River Mile
SARA	Superfund Amendment Reauthorization Act
SI	Site Inspection
UFP	Uniform Federal Policy
USEPA	U.S. Environmental Protection Agency
USACE	U.S. Army Corp of Engineers

1.0 INTRODUCTION

CTI and Associates, Inc., (CTI) was tasked by the United States Army Corps of Engineers (USACE) and the United States Environmental Protection Agency (USEPA) to provide technical support for completion of a Site Inspection (SI) for the Lower Hackensack River (LHR) in Bergen and Hudson counties, New Jersey (Site ID No: NJN00201845). CTI will conduct the SI activities under USACE Kansas City District Contract Number W912DQ-13-D-3014, Task Order Number 009. The LHR Preliminary Assessment (PA), completed in September 2015, identified contaminated sediments extending from approximately south of the Overpeck Creek tributary to the mouth of the Hackensack River based on the environmental data repository compiled by the National Oceanic & Atmospheric Administration (NOAA). The EPA SI process is intended to evaluate actual or potential environmental hazards at a particular site relative to other sites across the nation for the purpose of identifying remedial action priorities. The SI, under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), is intended to collect sufficient data to enable evaluation of a site's potential for inclusion on the National Priorities List (NPL) and establish priorities for additional action, if warranted. The decision as to whether a site is placed on the NPL is made based on the EPA's Hazard Ranking System (HRS) criteria. The HRS assesses the relative threat to human health and the environment associated with the actual or potential releases of hazardous substances at a site. This FSP, and hence, the SI process, is not intended to include extensive or complete site characterization, contaminant fate determination, or quantitative risk assessment.

This Field Sampling Plan (FSP) presents the procedures for implementing the field work in conjunction with the UFP-QAPP (CTI 2016). The LHR SI Study Area presented in **Figure 1-1** is defined in the Hackensack River Preliminary Assessment (PA) as the portion of the Lower Hackensack River located between the Oradell Dam (River Mile [RM] 23.3) and the mouth of the river in Newark Bay (RM 0.0).

The purpose of this FSP is to provide sufficient information for the field team to properly conduct surface and subsurface sampling and sample processing activities, and to describe the methods and procedures to be implemented during SI field activities to meet the SI objectives (see Section 3.1). The FSP is organized into 8 sections. Section 1 provides an introduction to the LHR SI Field Program and Section 2 presents the LHR Study Area background and history. Section 3 presents the objectives of the SI and sampling approach and Section 4 presents the SI Field task methods and procedures including mobilization, surface and subsurface sediment sampling, field documentation, equipment decontamination, and Investigation Derived waste management. Quality assurance (QA) and quality control (QC) procedures to be followed during implementation of the SI are presented in Section 5, reference to the SI HASP is provided in Section 6, a brief schedule is presented in Section 7, and references are presented in Section 8.

Each section of this FSP has been developed as a “stand-alone” guide to the sampling activities discussed in that section, so that field staff can complete the sampling with the information contained in that section.

2.0 STUDY AREA HISTORY AND BACKGROUND

The following section provides a brief summary of the Study Area history and background. A more detailed presentation of Study Area history, background information and distribution of contaminants is presented in the Preliminary Assessment, Lower Hackensack River, Bergen and Hudson Counties, New Jersey, USEPA (September 2015).

The Hackensack River is approximately 45 miles long, originating at Lake Lucille in New City Rockland County, New York, and empties into Newark Bay, New Jersey. The portion of the Lower Hackensack River undergoing this SI is located between the Oradell Dam (RM 23.3) and the mouth of the river in Newark Bay (RM 0.0) (see **Figure 1-1**). The river miles shown of **Figure 1-1** and all subsequent FSP figures are based on published Hackensack River miles (33 CFR §117). This section of the river spans across Bergen and Hudson counties, New Jersey, and includes the Hackensack Meadowlands and several tributaries. The Hackensack Meadowlands District (HMD) is a 5,445-acre estuarine emergent wetland (half of the total wetland/pond acreage along the Hackensack River) located just a few miles north of Newark Bay. There are 17 named tributaries to the LHR below the Oradell Dam, however, there are several other smaller tributaries that empty directly into the Hackensack River or into one of the identified tributaries due to the estuarine river environment. Tributaries to the LHR are shown on **Figure 1-1**.

Current land uses in the northern section of the study area, north of the HMD, generally follow suburban development patterns characterized by low densities, larger lot sizes, and winding streets with cul-de-sacs. Land uses in the northern part of the study area primarily consist of residential, commercial, and public. Land uses along the LHR in the lower section of the study area consist primarily of industrial, open space wetlands/forested, and public with some residential and some commercial land surrounding the HMD. Over for the entire study area, residential is the largest percentage of land use, followed by public land and industrial land.

3.0 FIELD SAMPLING APPROACH

3.1 Objectives and Approach

The objective of the LHR SI is to provide the chemical and physical data required to complete the SI report and HRS documentation record to determine if additional investigation under CERCLA may be warranted at the site. To meet these objectives, a review of available NOAA environmental data repository laboratory analytical data was conducted to identify potential data gaps. Based on this review, it was determined characterization of the LHR surface and subsurface sediment contamination and documentation of background concentrations of hazardous substances in sediment through a scientifically sound comprehensive investigation was necessary to complete the SI report and HRS documentation record. The proposed LHR SI will provide data that will be used to map where contamination is located and where potential sources and releases may exist along the river. The current NOAA environmental data suggests there are contaminated sediments along the river and that flood and ebb tidal influences over the industrial history of the LHR has resulted in contaminant mixing and consolidation in depositional areas, making it difficult to identify the source of any particular release.

Background sample locations have been selected to represent the upstream river conditions near Oradell Dam in the residential/commercial section of the LHR, the industrialized section of the LHR in the vicinity of Overpeck Creek, and the mouth of the LHR where flood tidal influences may impact the sediment quality of LHR due to upstream migration of potential contaminants during flood tide.

Similarity between release samples and proposed background sampling locations included sample collection procedures and depths, analytical methods and laboratories, sample time frame, physical setting, salinity associated with the estuarine river environment, and sediment depositional environment. The objective is to collect background samples as similar as possible to the release samples used to establish an observed release by chemical analysis, sediment grainsize distribution, and total organic carbon (TOC).

The sampling strategy was developed using the NOAA Environmental data and information presented in the LHR PA. This existing NOAA data was used to identify sampling locations and will be used to provide quantitative evidence of historic contamination in the LHR.

The methods and procedures for sample collection and handling to address the above objectives are described herein, and will be pursued according to the 40 CFR Part 300, Hazard Ranking System, Final Rule. Sample stations for the SI Field Program are provided in **Figures 3-1 thru 3-4**. A detailed breakdown of the LHR sample stations by river mile is presented in **Attachment A**. SI field activities will be conducted in accordance with this UFP-QAPP/FSP and HASP (CTI 2016).

The SI field work is designed to broadly characterize the physical properties and chemical nature of the sediments along the length of the LHR. The Hackensack River SI sampling approach includes co-located surface sediment and subsurface sediment samples collected in the fine grained depositional sections of the river (point bars, subtidal and tidal flats, etc.) from the river's mouth to the Oradell Dam. Sediment sample locations were selected based on review of historical aerial photography depicting low tide sediment deposits and the 2007 multibeam bathymetric survey, side scan sonar imaging, sub bottom profiles, and sediment core data provided in the *Final Report Geophysical Investigation as part of the Design of the Hackensack River Enhancement Project, (USACE-NYD, July 2008)*. Evaluation of this data and specifically the bathymetric survey and sediment characterization data provided insight into viable sample location from the mouth of the Hackensack River (RM 0.0) to the Overpeck Creek tributary at river mile 13.5. The LHR sample stations depicted on the 2007 bathymetric survey for river miles 0.0 to 13.5 are presented in **Attachment B**.

Upstream of Overpeck Creek, depositional sections of the LHR were identified through low tide aerial photography interpretation, review of NOAA navigation charts (Passaic and Hackensack River, United States – East Coast, New Jersey, Chart No. 12337), and evaluation of river geomorphology. The LHR sample stations depicted on the NOAA navigation charts for river miles 0.0 to 17.0 are presented in **Attachment C**. By focusing sample collection strategy in the fine grained sediment depositional sections of the river, surface and subsurface samples representative of recent and historical sediment contamination with similar grainsize and total organic carbon should be collected.

The 2008 Geophysical Investigation Report also summarized the dredging history of the Hackensack River. A shipping channel has been dredged from the mouth of the Hackensack River to the turning basin at river mile 3.75. Based on the Geophysical Survey Report, river maintenance dredging has been historically performed along various river sections over time, up to approximately river mile 14.5. The NOAA navigation charts indicated a maintained river channel up to approximately river mile 17.1. In consideration of the dredging history, proposed sediments sample stations have been located outside the shipping channel.

3.2 Sample Locations and Analysis

Based on access restrictions to sections of the river due to low bridge clearance or the narrow channel

in the upper section of the river (estimated to be above RM 19.0), the following sample collection strategy and sampling methods will be used for the LHR SI:

- River Mile 0.0 to 19.0: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Vibra-core) per location. (**Figures 3-1 thru 3-4**)
- River Mile 19.0 to 22.0: One surface grab (Ponar/Ekman dredge) per location. (**Figure 3-4**)
- Hackensack River Tributaries, Mile 0.0 to 22.5: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Vibra-core) per location. (**Figures 3-1 thru 3-4**)
- Background Sample Locations:
 - River Mile 22.25 to 22.5: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Piston Sampler) per location. Total sample locations = 4. This background location is located adjacent to the New Milford Plant of the Hackensack Water Company in the brackish water section of the Hackensack River. (**Figure 3-4**)
 - Overpeck Creek at Hackensack River RM 13.5: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Vibra-core or Piston Sampler) per location based on access. Total sample locations = 4. These background locations are located in brackish water downstream of the Overpeck Creek dam and upstream of the Hackensack River. (**Figure 3-3**)
 - Newark Bay / Mouth of Hackensack River RM 0.0 to 0.5: One surface grab (Ponar/Ekman dredge) and one subsurface sample (Vibra-core) per location. Total sample locations = 4. These background locations are dual purpose samples co-located with the LHR SI surface and subsurface sediment stations. These locations will be evaluated to determine if they are representative of the LHR flood tide background location. (**Figure 3-1**)

LHR sample stations by river mile are presented in **Attachment A**. Sample stations shown designate a position within a specific depositional feature on the LHR. Due to the ongoing migration of sediment deposits within the river estuarine environment, the final sample station with respect to the distance from shoreline may vary due to water depth information monitored during sample vessel positioning, tide cycle, and field location of the specific depositional feature. As a result, sample stations may be adjusted perpendicular to the shoreline to provide access to the proposed location by the sample vessel. GPS coordinates for each sample station are presented on **Table 3-1**.

Surface sediment samples will be collected from the sediment surface to a depth of approximately 10 cm. The surface sediment locations will be co-located with the subsurface sediment cores extending up to 10 feet (305 cm) below sediment surface. To allow for preliminary assessments of depth and volume of contaminated sediment within the LHR study area, one distinct sample interval will be selected from the subsurface sediment core based on visual inspection, odor, oily residue, or sheen and composited for chemical and physical characterization. All surface sediment samples and subsurface sediment cores will be logged prior to sample processing for analysis.

Based on the potential contaminants identified through evaluation of the environmental data repository compiled by NOAA and the LHR PA, all surface and subsurface sediment samples will be analyzed for RCRA metals, semi-volatile organic compounds (SVOCs), mercury, total organic carbon (TOC), and PCBs. Grainsize analysis will be completed on 30% of the samples

collected to evaluate the grainsize distribution of the LHR depositional environments.

3.3 Modifications to the SI Field Program

It is anticipated that during the SI Field Program there may be modifications to the sampling approach identified in the SI QAPP/FSP. These changes may include moving a sample station due to obstruction, utility, or refusal or the addition of a sample station or sample.

Minor changes in sample location (e.g., moving a location a reasonably short distance, adjusting core location due to refusal, adjusting sample interval, collecting opportunistic sample) will be considered an allowable field decision and will be reported to USACE/USEPA on the Daily Quality Control Reports and in routine status reports (weekly field status reports and monthly status reports). For changes that require a significant deviation from the SI QAPP/FSP, USACE/USEPA will be notified for concurrence prior to initiate significant deviations.

4.0 METHODS AND PROCEDURES

4.1 Mobilization Activities

The following activities will be performed to mobilize for the SI Field Program:

- Establishment of field facility
- Procurement of subcontractors, materials, and equipment
- Procurements of permits
- Marine utility clearance or other hazards within the LHR

4.1.1 Field Facilities

Prior to the initiation of the SI field sampling, a field facility will be established adjacent to the Hackensack River Barge Park which is centrally located to the LHR and will have direct access to the Hackensack River. The Barge Park public boat launch/marina facility will be used to moor the sampling vessel overnight and weekends for the duration of the project. Alternate private and/or public boat launch facilities may be used to gain access to sections of the river that are restricted due to low bridge clearance or the restricted channel in the upper section of the river (presumed to be above RM 19.0). Vehicles will be used to transport field personnel, equipment, and sample containers/coolers from the field office facility to the remote boat launch facilities.

The field facility will include an office trailer with electricity, air conditioning, heat, telephone, and internet access. The field facility will include an appropriate area for processing samples, office paperwork, and a storage container for secure storage of supplies (e.g., sample containers, coolers, and field equipment). Investigation Derived Waste (IDW) including decontamination fluids and soiled PPE will be containerized in properly labeled 55-gallon Department of Transportation (DOT) approved drums prior to disposal at an appropriate waste disposal facility (see Section 4.10). The field facility will include a secure space for temporary storage of these drums.

4.1.2 Procurement of Permits

Per 40 CFR 300.400, CERCLA response actions are exempted by law from the requirement to obtain federal, state, or local permits related to any activities conducted completely within the established

CERCLA site. Therefore permits are not required to conduct sampling during the LHR SI field program

4.1.3 Marine Utility Clearance

State law requires that a utility clearance be performed prior to initiation of any subsurface work. This requirement also applies to work on water where there may be submerged utilities. New Jersey One Call Center at 800-272-1000 or 811 will be contacted to mark-out of natural gas, electric, telephone, cable television, water, and sewer lines for the LHR. The One Call utility mark-outs include a 10-day expiration date beyond which the mark-out is not valid unless markings are preserved. Subsequently, the Field Manager and marine subcontractor will forecast upcoming segments of river where work will be conducted and ensure utility clearance is performed and remains current during sampling in that segment of the river.

In addition to New Jersey One Call, CTI has reviewed the *Final Report Geophysical Investigation as part of the Design of the Hackensack River Enhancement Project*, (USACE-NYD, July 2007). The geophysical investigation report provides magnetic field density survey coverage of river miles 0.0 to 13.5 and identified the location of nineteen pipelines and cable conduits across the river as well as a large amount of pipe, wood piling, and other debris along the bottom throughout the LHR. NOAA navigation charts were also reviewed which indicate general pipeline and cable crossing locations for river miles 0.0 to 17.0 for navigation purposes. This data has been compiled into a comprehensive marine utility data set to identify potential areas where utilities may be present in the river and will be correlated with the New Jersey One Call utility mark-outs. Mapped marine utilities with respect to sediment sample stations, the magnetic field density survey coverage of river miles 0.0 to 13.5, NOAA navigation charts, and New Jersey One Call Procedures are presented in **Attachment D**.

Work will not begin until the required utility clearances have been performed and utility crossing have been identified, confirmed, and mapped. Current sediment sampling stations have been located to avoid the marine utilities as shown in **Attachment D**. Sample stations will be reviewed in relation to New Jersey One Call utility locations and relocated or adjusted accordingly. To be conservative, stations for sediment sampling will be at least 100 feet horizontally from any utilities or related utility infrastructure. USACE/USEPA will be notified of significant relocation of sample stations due to identified or suspected marine utilities.

4.2 Daily Pre-sampling Activities

Daily pre-sampling activities completed at the Barge Park field office are summarized below:

- Prepare the daily float plan for communication between the land and boat-based field team staff, identification of stations to be sampled, bridge passage requirements, tidal stage schedule, alternate access points along the LHR, and potential sample transfer/resupply locations. Target coordinates will be pre-loaded into the vessel DGPS unit.
- Daily Tailgate Health and Safety Meeting to review of HASP for potential hazards, appropriate PPE, tide cycle/bridges, and potential weather concerns.
- Confirm utility clearance for sample locations and the general area within the LHR to ensure all utility crossings have been identified and sample locations relocated 100 feet from any utilities or related infrastructure.
- Confirm the type of boat for sampling based on logistical constraints due to bridges, tides and equipment required for sampling. A medium-sized pontoon boat is proposed for open channel river

sampling activities estimated to extend from river miles 0.0 to 19.0. A smaller john boat will be used in the upstream portions of the LHR (RM 19.0 to 22.0) and background locations inaccessible with the pontoon boat.

- Check tide charts for water level conditions throughout the sampling period and plan sample location access accordingly.
- Check weather conditions and monitor throughout the day for changing conditions, both onboard the sample vessel and at the field office.
- Prepare sample station specific sample kits containing all necessary pre-labeled glassware, field forms/paperwork, and field packaging materials for both the surface and subsurface sample. Daily sample table including station number, GPS coordinates, analyses to be conducted, QA/QC samples required and sample location map.
- Prepare daily supply of single-use, decontaminated stainless steel composite bowls, spoons, etc., plastic sheeting and other supplies for on-boat sample processing. Coolers with blue ice will also be prepared for sample storage following processing. Sample processing equipment will be decontaminated at the Barge Park field office following each day of field sampling.

It is anticipated that the boat crew for pontoon vibra-core river sampling activities will consist of four field staff including a boat captain and three crew members. The john boat crew will likely be comprised of one boat captain and 2 crew members. One support boat will be available, if necessary, for transporting additional sample location specific sample coolers to the pontoon boat and returning with completed location specific sample coolers. The boat crew will be in communication with the Field Manager during sampling activities to ensure they have adequate materials and supplies to complete the daily float plan. Prior to departure, sample materials (glassware, paperwork, processing equipment, etc.), sample coolers and equipment, decontamination fluids and IDW containers will be secured on the boat. Any on-water specific health and safety issues will be discussed by the boat captain prior to boarding. The captain will complete an inspection of the boat including an inventory of required safety gear (i.e., USCG required equipment, personal flotation devices, communication equipment, DGPS, etc.), conduct a communications check, and review the daily float plan with sample personnel.

4.3 Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the subsurface sediment sample collection activities. Additional equipment may be required, pending field conditions.

- Sampling vessel equipped with necessary differential global positioning system (DGPS) navigation and communication equipment
- Ponar/Ekman Dredge, Piston Core sampler, and Vibra-core equipment
- Assorted nautical and USCG required equipment (e.g., anchors, lines, personal flotation devices, first aid kit)
- Approved documents including:
 - Health and Safety Plan (HASP)

- Field Sampling Plan (FSP)
- Quality Assurance Project Plan (QAPP)

Required Field Forms (**Attachment E**) include the following:

- Daily Time Log
- Field Change Log
- Surface Sediment Field Log
- Subsurface Sediment Core Log
- Sample location coordinates and maps
- Sample station kits
- Black, ballpoint pen or Sharpie® (or equivalent)
- Bound, waterproof field logbooks
- Bristle brushes
- Chain of Custody forms
- Clipboards
- Custody tape or seals
- Decontamination supplies
- Digital camera and cell phone
- Ruler and tape measures
- Plastic sheeting and duct tape
- Sample processing equipment
- Weighted tape for river depth measurement
- Coolers, ice, and packing material
- Plastic wash/rinse buckets or tubs
- Siphon tubing and bucket
- Small (cooler-size) storage containers
- Squeeze and/or spray bottles
- Stainless steel bowls and spoons/spatulas (or equivalent)
- Tap water source (any treated municipal water supply)
- Water pump and hoses (optional)
- Zipper-lock bags
- 30-gallon (minimum) garbage bags
- 5-10 gallon carboys to be used as satellite waste collection containers

- 5-gallon buckets with lids

4.4 Sample Location Positioning

Upon marina departure, the captain will navigate the boat to the target sample station based on GPS coordinates and visual observation of the station based on aerial photography. River depth will be monitored to confirm the proper river depositional feature is present at the sample station and direct measured upon vessel anchoring. Care will be taken to place anchors at a distance where they will not cause disturbance of sediments in the vicinity of the designated sampling station. Final GPS location coordinates will be recorded for each target sample station as well as date/time, water depth, tide flow direction, and weather conditions. Vertical elevation of each sample location will be converted to mean lower low water (MLLW) elevation.

Sediment sampling activities will be initiated at the mouth of the Hackensack River and progress up-river to the Oradell Dam. If access to a station or stations is not possible due to tide stage or other issues, the station(s) will be sampled when access conditions improve.

During sediment sampling and other on-water activities, a visual survey will be performed of the immediate sample station shoreline for intertidal shoreline seeps (e.g., fluid emerging from the shoreline), overland flow locations, flow from outfalls and other pipes discharging to the sample area, estimate of rate of discharge, and visual signs of impacts (e.g., sheens, color, and solids).

In addition, recreational and ecological use of the LHR in the vicinity of the sample station will be documented in photographs and on the sample station field forms. The types of potential recreational activities that the field team staff will look for will include kayaking or other non-commercial water craft, fishing on the water or from the shore, and crabbing along the shore. Persons observed fishing will be interviewed to determine if they consume the fish caught in the river. As part of the ecological evaluation, the field team staff will make observations of wetland quality along the shoreline adjacent to the sample station.

Once the boat is secured on location, the surface sediment sample will be collected first using a Ponar or Ekman Dredge or other suitable sample device, followed by the subsurface sample collected by vibra-core. Upon completion of station sampling, excess sediment sample will be returned to the river. The stainless steel mixing bowls and spoons will be river rinsed and placed in a sealed container for on-shore decontamination. The Ekman/Ponar Dredge and vibra-core equipment will be decontaminated and secured prior to moving to the next designated sample station. Equipment decontamination procedures are presented in Section 4.9.

Sampling procedures for surface sediment and subsurface sediment are described in the following sections. Field tasks will be documented, and this documentation will be reviewed by the Field Manager, digitally scanned, and stored in the facility project files. Photographs will be taken of the sample stations and any significant observations made during sampling.

4.5 Surface Sediment Sampling

Surface sediment samples for chemical analysis, geotechnical testing, and visual description collected from 0 to 0.32 feet (0 to 10 cm) below the sediment surface using an Eckman or Ponar Dredge sampler, as appropriate for the type of sediment sample being collected. If a grab sampling technique is

unsuccessful at collecting a surface sediment sample, other techniques, including collecting the sample from the vibra-core sediment core, presented in Section 4.6, will be considered.

Once the sample vessel is in position, the sampler will be lowered by hand to the sediment surface and allowed to penetrate into the sediments. The sample device will be triggered for the collection of the surface sediment sample. The sampler will be raised slowly to prohibit washing of the sediment from the sampler. Depending on the sediment type and depth of penetration, several attempts may be required to obtain acceptable surface sediment volume. The sampling equipment will not be decontaminated between discrete samples at a designated sample location.

At each sampling station, sufficient volume will be collected for chemical and physical analysis. If multiple attempts are required to attain adequate volume, the grabs will be composited and homogenized prior to filling the required analytical bottles for the sample location, including duplicate and MS/MSD samples. Surface sediment samples will be processed on the boat. **Table 4-1** includes a summary of the sample containers and analysis required. Sample processing procedures for chemical and physical characterization include the following:

- Sediments in each grab sample will be classified using the Unified Soil Classification System (USCS) and information recorded on the Surface Sediment Grab Form to include primary grain size, minor constituents, stratification/layering, color, consistency, odors, and visible evidence of impacts (e.g., sheen), debris (glass, nail, etc.) and presence or absence of benthic macroinvertebrates.
- A photographic log will be kept of each grab sample. For each sample, a representative photograph will be taken with a place card of the sample location and sample interval, date, and a ruler will be visible in the photograph.
- Sediment will be composited and samples will be placed in the appropriate laboratory-provided sample containers.
- Samples for geotechnical and TOC analysis will be collected from the same composite sample collected for chemical analysis.
- The surface sediment samples will be placed on ice pending transport to the sample processing area where the samples will be packaged for shipping.

Sediment material in unacceptable grabs and excess sample not contained in sample containers will be returned to the river. Sample collection equipment will be cleaned and decontaminated between sampling stations in accordance with Section 4.9 Equipment Decontamination. Decontamination fluids and spent PPE will be containerized separately as IDW. IDW will be transferred to the field office facility, and disposed of according to Section 4.10 – Investigation-Derived Waste (IDW) Handling and Disposal.

4.6 Subsurface Sediment Sampling

This section describes the procedures that will be followed to perform the subsurface sediment sampling activities. Subsurface sediment samples for chemical analysis, geotechnical testing and visual description will be collected by vibra-core methods to achieve contact with the native soil unit or to a depth of approximately 10 feet (305 cm) below the sediment surface, whichever occurs first. In the upper reach of LHR where access by the pontoon sample vessel is restricted, subsurface sediment samples will not be collected. At SI background locations, a piston core or other direct-

push method will be used to collect subsurface sediment samples.

4.6.1 Sampling Procedures – Vibra-core

Sediment cores will be collected at each location using vibra-core techniques. If possible, the core barrel will be lowered slowly to the sediment surface and allowed to penetrate into the sediment and then vibrated as little as possible. Once the core is retrieved, the field team staff will evaluate whether the core is acceptable to be retained for processing based on the following criteria:

- Overlying water is present and the sediment surface is intact
- The core liner appears intact without obstruction or blocking
- Recovery is greater than 60 percent of drive length

4.6.2 Sampling Procedures – Piston Sampler

Sediment cores for background sample locations inaccessible by the vibra-core sample vessel will be collected manually using a piston sampler. The 4-foot piston sampler barrel will be lowered slowly to the sediment surface and pushed into the sediment using extension rods in a single continuous motion. The suction piston will be retracted inside the core tube as the tube is advanced. Upon removal, the core tube will be capped prior to breaking the water surface to minimize the potential for sediment loss. Once the core is retrieved, the field team staff will evaluate whether the core is acceptable to be retained for processing based on the following criteria:

- Overlying water is present and the sediment surface is intact
- The core liner appears intact without obstruction or blocking
- Recovery is greater than 60 percent of drive length

4.6.3 Subsurface Sediment Core Processing

Sediment cores will be processed on the sample vessel following core acceptance as follows:

- Excess water in the core will be removed prior to further processing
- Split the core into longitudinal halves using a decontaminated flat blade tool (spatula or putty knife, etc.) into each sediment interval through the cuts in the core liner. Carefully separate the core half-sections, and align them on the plastic sheeting.
- Sediments in each core will be logged using the USCS on a Sediment Core Form to include primary grain size, minor constituents, color, consistency, odors, and visible evidence of potential contamination (e.g., sheen).
- One subsurface sediment sample interval indicative of potential contamination (sheen, odor, oily residue, etc.) will be selected for chemical, geotechnical, and TOC analysis. The length of the sample interval will be determined in the field by visual observation of potential contamination, grain size distribution, and stratigraphic sequencing.
- A photographic log will be kept of the core. For each core, a representative photograph of the entire core will be taken with a place card of the sample station, selected sediment sample interval, and a ruler visible to provide scale. A second photograph will be taken of the specific sample interval selected for chemical, geotechnical, and TOC analysis.

- Sediment selected for chemical, geotechnical, and TOC analysis will be placed in a single-use stainless steel mixing bowl and homogenized until uniform in color and texture. The sample will be placed into the appropriate sample jars as shown on **Table 4-1**. The final composite volume must consist of sufficient sediment to fill all required sample jars. Samples for geotechnical and TOC analysis will be collected from the same composite sample collected for chemical analysis.
- The surface sediment samples will be placed on ice pending transport to the sample processing area where the samples will be packaged for shipping.
- All single-use sediment processing equipment (stainless steel mixing bowls, spoons, trowels, etc.) will be decontaminated at the Barge park field office in accordance with Section 4.9 Equipment Decontamination.
- Excess sediment will be returned to the river following sample processing.

4.7 Sample Handling, Packaging and Shipment

Samples will be transferred from the sample custodian on the boat to the sample custodian at the Barge Park field office. Once samples are received at the field facility, the samples will be checked and information will be entered onto a COC Record for transport to the laboratory. Sample containers will be stored at 4 degrees Celsius (°C) pending shipment to the laboratory.

4.7.1 Sample Containers

To preserve sample integrity, sample containers will be obtained from a scientific supply vendor. Containers will be pre-cleaned per the requirements in EPA guidance documents (EPA 1989).

Container requirements vary according to analyte, sample matrix, and hazard classification. It is anticipated that samples collected for the project will be low hazard. **Table 4-1** summarizes the type and number of sample containers required.

4.7.2 Sample Packaging

Packaging required for samples being sent from the site to the analytical or geotechnical testing laboratory via express courier include the following:

- Using packing tape, secure the outside and inside of the drain plug at the bottom of the cooler that is used for sample transport (if applicable).
- Place each container or package in individual polyethylene bags (Ziploc®-type) and seal.
- Place one to two inches of cushioning material at the bottom of the cooler.
- Place the sealed sample containers, including temperature blank, and package upright in the cooler.
- Package ice in double lined Ziploc®-type plastic bags and place loosely in the cooler. Do not pack ice so tightly that it may prevent addition of sufficient cushioning material.
- Fill the remaining space in the cooler with cushioning material.
- Place the completed chain-of-custody forms in a large Ziploc®-type bag and tape the forms to the inside of the cooler lid. Close the lid of the cooler and fasten with packing tape.
- Wrap strapping tape around both ends of the cooler at least twice.

- Mark the cooler on the outside with the following information: shipping address, return address, "Fragile" labels on the top and on one side, and arrows indicating "This Side Up" on two adjacent sides.
- Place a signed custody seal label over front right and back left of the cooler lid and cover with clear plastic tape.

4.7.3 Sample Shipment

Shipping and handling of samples will be done in a manner that protects both the sample integrity and shipment handlers from the possible hazardous nature of the samples. Packaging, marking, labeling, and shipping of samples will comply with applicable transportation regulations. All samples will be delivered 24 hours of shipment by an express carrier. The following chain-of-custody procedures will apply to sample shipping:

- Relinquish the sample containers to the laboratory via express carrier. The signed and dated forms should be included in the cooler. The express carrier is not required to sign the chain-of-custody forms. The sampler should retain the express carrier receipt or bill of lading.
- When the samples are received by the laboratory, the laboratory personnel shall complete the chain-of custody forms by recording receipt of samples, measure and record the internal temperature of the shipping container, and then check the sample identification numbers on the containers to the chain of custody forms.

4.8 Documentation

4.8.1 Documentation

Field activities will document sample station information, sediment sample collection, equipment decontamination and sample custody information. Field team members will keep a daily record of significant events, observations, and measurements on field forms. Field activities will be recorded on forms specific to the collection activity and will be reviewed and maintained by the Field Manager. Field notes will be maintained for all field activities. The on-site field personnel will record on the field log forms information pertinent to the investigation, including, at a minimum, the following information:

- Project name
- Field personnel on site
- Facility visitors
- Health and safety discussions
- Sample station number, vessel GPS coordinates, and duration on sample station
- Date and collection time of each sediment sample
- Observations made during sample collection including weather conditions, complications, vessel traffic, and other details associated with the sampling effort
- Sampling method and description of activities
- Any deviations from the FSP or UF-QAPP

In addition to maintaining a daily field log, sample collection forms will be completed for each sample. The sample collection forms, presented in **Attachment E**, will include standard entries for station identifier, station coordinates, date and time of sample location, type of samples collected, type of analyses for each sample, and specific information pertaining to the matrix being collected. Additional specific field reporting requirements and checklists are defined in the sample procedures. In general, sufficient information will be recorded during sampling so that reconstruction of the event can occur without relying on the memory of the field personnel. The responsible field personnel will complete field documentation in its entirety and sign and date the bottom signature line of each field form.

Field notes should be kept on water-resistant paper and all field documentation will be made using an indelible, waterproof ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, then dating and initialing the change. Blank pages or lines in the field logbook will be lined-out, dated, and initialed at the end of each sampling day. The field forms will be scanned into the project file directory on a daily basis.

Field forms and notes will be reviewed by the Field Manager, scanned, and saved to the project files. Photographs will be taken of surface grab samples, subsurface sediment core and the subsurface sediment core sample intervals selected for analysis along with any significant observations made during sampling. Photographs will be transferred to the project electronic files daily.

4.8.2 Sample Designation

Unique sample identification numbers have been established for each sample station. The nomenclature that will be used is {matrix code} {station identification number} - {modifier} where:

A 2-character matrix code will be used to indicate the sample matrix. Matrix codes are as follows:

SS = Surface Sediment Sample

VC = Subsurface Sediment Core Sample collected by vibra-core

PS = Subsurface Sediment Core Sample collected by piston sampler

Station identification = 6-character identifier for each station identified in **Appendix A**. The station identifier will begin with a 3-character identifier “LHR” to identify the station as located on the Lower Hackensack River, followed by 3-digit station number that indicates the sequential numbering of sample stations from the mouth of the LHR at river mile 0.0 to 22.0. There are a total of 190 sample stations along the LHR.

Sample designation modifiers include the following:

- Field duplicates will be identified by adding 01 after the Station identifier.
- Matrix spike / matrix spike duplicates will be identified by MS/MSD after the matrix code.
- RB = Rinsate Blank (Require a station identifier/matrix code to correlate to original sample.)
- Background sample stations will be identified by adding BG after the matrix code. Background sample stations are designated as distinct sample stations by a separate 3-digit station number that indicates the sequential numbering of background sample stations. There are a total of

eight background sample stations. (four adjacent to the New Millford Water Treatment Plant near the Oradell Dam, and four at Overpeck Creek, and four co-located background/LHR characterization sample station located at river mile 0.0 to 0.5)

Sample designation examples:

- A surface grab sample collected at the 26th station of the LHR collected would have the sample designation: SSLHR026
- The duplicate of this sample would have the sample designation: SSLHR02601
- A subsurface sediment core sample collected by vibra-core co-located at the 26th station of the LHR would have the sample designation: VCLHR026
- A rinsate blank collected in association with subsurface sediment core sample collected by vibra-core at the 26th station of the LHR would have the sample designation: SSLHR026RB

4.8.3 Chain-of-Custody Procedures

Sample custody is a critical aspect of the HRS documentation package. The possession and proper handling of samples must be traceable from the time the samples are collected until the data have been accepted for analysis so that re-analyses may be conducted without concern for possible introduction of contaminants.

The purpose of custody procedures is to provide a documented, legally defensible record that can be used to follow the possession and handling of a sample from collection through analysis. A sample is in custody if it is:

- In someone's physical possession or view, and/or
- Secured to prevent tampering, and/or
- Secured in an area restricted to authorized personnel.

Field Custody Procedures

Sample control and chain-of-custody procedures in the field and during shipment will be performed in accordance with the procedures in the CLP User's Guide (EPA 1991). Each sample will be assigned a unique identifying number. Labels will be filled out in waterproof ink prior to sample collection to minimize container handling. Sample label and chain-of-custody forms will include the following information:

- Name of sampler
- Date and time of sample collection
- Sample number
- Sample matrix and how collected (i.e., grab, composite)
- Analyses required

Laboratory Custody Procedures

Laboratories supporting this project will have custody procedures commensurate the EPA Contract Laboratory Program Statement of Work (CLP SOW). These procedures document and describe the acceptance, internal transfer, and final reporting of samples.

4.8.4 Data Processing, Analysis, and Management

Data collection records from sediment sampling activities, including sample collection, processing, and sample management will be reviewed by the Field Manager, scanned, and transferred to the on-site electronic project files. On-site data files will be uploaded to the LHR FTP site on a daily basis.

Analytical data will be validated by USEPA. Analytical data will be maintained in the project database and accessible only by designated project personnel.

4.9 Equipment Decontamination

Surface and subsurface sediment sampling equipment decontamination will be performed onboard the sample vessel following the use of each piece of equipment. Sediment process equipment will be single-use and will be decontaminated at the end of each day of sampling at the Boat Park Field Office.

Equipment and Supplies

The following is a list of equipment that may be for equipment decontamination. Additional equipment may be required, pending field conditions.

- Personal protective equipment (PPE) as required by the HASP
- Scrub brushes
- Plastic wash/rinse buckets or tubs
- Phosphate-free biodegradable detergent (e.g., Liquinox®, Alconox®)
- Deionized (DI) water
- Spray bottles
- Tap water source (any treated municipal water supply)
- Laboratory grade Hexane
- Investigation-derived waste (IDW) storage containers

Procedures for Decontamination of Sampling and Processing Equipment

Equipment used that are in direct contact with the sample medium will be decontaminated prior to use in the field. The following steps will be used to decontaminate supporting equipment such as boats, lines, ropes, buoy marker weights, and current meters that are not in direct contact with samples or sediment:

- Equipment will be rinsed with ambient water onboard the boat
- Rinse water will not be contained
- All sediment spilled on the decks will be placed overboard.

- Ongoing decontamination of the decks of the boats will continue throughout the day to keep the decks clean.

The following decontamination steps will be used to decontaminate sampling equipment that comes into contact with sample media. Decontamination of all items will follow the Field Branches Quality Management Plan (USEPA 2009) and SW-846 protocols. The decontamination procedure is as follows:

- Residual sample media on equipment will be rinsed, scrubbed off, and returned to LHR.
- Pre-wash rinse with tap water
- Wash with solution of tap water and soap (brush)
- Rinse with tap water
- Spritz with laboratory grade Hexane
- Rinse with DI water
- Use immediately or store decontaminated items for future use

All used decontamination fluids will be collected and placed in labeled, designated containers suitable for disposal in accordance with IDW procedures outlined in SOP NC-15 – IDW Handling and Disposal.

4.10 Investigation Derived Waste

Investigation derived waste will be generated during the performance of the sediment sampling and during equipment decontamination. Materials that are known or suspected to be contaminated with hazardous substances through the actions of sample collection or personnel and equipment decontamination are said to be IDW. These wastes are classified into three categories:

- Solid materials consisting of sediments, used core tubes, used PPE, and other materials used in the handling, processing, and storage of sediment
- Liquid wastes such as decontamination water and spent and residual chemicals (liquids) from decontamination.

Solid Waste

Solid wastes include items such as used core liners, paper towel, PPE (e.g., gloves, Tyvek® suits, and plastic sheeting) will be segregated and stored in separate containers pending disposal. Loose sediment will be removed from waste items prior to disposal to the extent practical. Sediment residuals will be returned to the LHR. Solid waste will be placed in 30-gallon plastic bags and temporarily stored pending disposal.

Equipment Decontamination Water

Decontamination water will be generated during sediment decontamination activities. Decontamination water will be collected in 55-gallon closed-top drums until the material is characterized and transferred off site for disposal.

Chemical Liquid Waste

Chemical liquid wastes may include spent solvents generated during the decontamination process. Waste solvents will be collected in dedicated satellite containers as follows:

- Waste solvents (hexane) will be collected in (jacketed) glass solvent bottles, and labeled with a Class 3 Flammable Liquid label.
- Waste containers will be stored in a secure location at the field facility until pickup by an authorized waste handler.

Both solid and equipment decontamination water IDW will be generated at onboard the sample vessel and during decontamination of sample processing equipment at the Barge Park Field Facility. These materials will be segregated and containerized in closed 5-gallon buckets or trash bags, as appropriate, on the boat and secured for transport. The containers will be transported to the field facility for consolidation in 55-gallon drums for subsequent disposal. A composite sample from each drum will be collected and analyzed for compounds specific to the disposal facility.

5.0 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

5.1 Field Duplicate Samples

Field QC samples will consist of sample field duplicates designed to monitor overall sampling and analytical precision. Blind field duplicates will consist of a homogenized sample that is split into two sample aliquots. Field duplicate frequency will be five percent of all sediment samples collected. Samples will be assigned unique numbers and will not be identified as duplicates to the laboratory. Sample stations for blind duplicate samples will be determined at the discretion of the Field Manager.

5.2 Matrix Spike / Matrix Spike Duplicate Samples

A matrix spike is an aliquot of a field sample that is fortified (spiked) with the analytes of interest and analyzed with an associated sample batch to monitor the effects of the field sample matrix (matrix effects) on the analytical method. Samples for matrix spike and matrix spike duplicate analysis will be designated by the Field Manager. QC samples will be selected based on visual and field monitoring results. An effort will be made to ensure that QC samples are representative of the samples analyzed (i.e., the most contaminated or cleanest samples will not be selected).

Matrix spike / matrix spike duplicate (MS/MSD) samples will consist of a homogenized sample that is split into two sample aliquots. Field MS/MSD frequency will be five percent of all sediment samples collected. Samples will be assigned unique numbers and will not be identified as duplicates to the laboratory. Sample stations for MS/MSD samples will be determined at the discretion of the Field Manager.

5.3 Equipment Rinsate Samples

Equipment rinsate samples will be prepared by rinsing sample collection and processing equipment with de-ionized water following equipment decontamination to confirm the effectiveness of equipment decontamination and the potential for sample cross contamination. Field equipment

rinsate sample frequency will be five percent of all sediment samples collected. Samples will be assigned unique numbers. Sample stations for equipment rinsate samples will be determined at the discretion of the Field Manager.

6.0 HEALTH AND SAFETY REQUIREMENTS

All FSP activities proposed for the SI Field Program will follow the procedures outlined in the site-specific HASP (CTI 2016). The HASP was prepared in accordance with the USACE Safety and Health Requirements Manual (EM 385-1-1) and Occupational Safety and Health Administration (OSHA) requirements contained in 29 Code of Federal Regulations (CFR) 1910 including the final rule contained in 29 CFR 1910.120.

All field team staff and subcontractor personnel must read and comply with the site-specific HASP and sign an acknowledgement form contained in the HASP. Visitors and new staff will be given a safety briefing by the CTI Site Safety Officer (SSO) to include a review of site environmental health and safety procedures required by the HASP and sign the corresponding acknowledgement form.

7.0 SCHEDULE

The SI Field Program subsurface sediment sampling activities are planned to be conducted in one field mobilization. It is anticipated that this subsurface sediment sampling will be conducted over a two-month time period. The schedule will be dependent on weather and field conditions.

8.0 REFERENCE

Ecology and Environment, Inc. Preliminary Assessment Lower Hackensack River Bergen and Hudson Counties New Jersey. September 2015.

EPA. Guidance for Performing Site Inspections under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), Interim Final. EPA/540-R-92-021 OSWER Directive 9345.1-05. September, 1992.

EPA. Hazard Ranking System Guidance Manual. 9345.1-07 EPA 540-R-92-026. November 1992.

NOAA. Passaic and Hackensack River, United States – East Coast, New Jersey, Chart No. 12337

U.S. Environmental Protection Agency (EPA). Hazardous Ranking System: Final Rule. Federal Register, Volume 55, No. 241. December 14, 1990.

USACE-NYD. Final Report Geophysical Investigation as part of the Design of the Hackensack River Enhancement Project, July 15, 2008.

Project-Specific FSP

Site Name/Project Name: Lower Hackensack River Site Inspection

Site Location: Bergen and Hudson Counties, NJ

Revision Number: 002

Date: June 1, 2016

Figures

Project-Specific FSP

Site Name/Project Name: Lower Hackensack River Site Inspection

Site Location: Bergen and Hudson Counties, NJ

Revision Number: 002

Date: June 1, 2016

Tables

Table 3-1
Lower Hackensack River Site Inspection
Sample Station GPS Coordinates

Sample ID	NJ-SPF Northing	NJ-SPF Easting	River Mile	Station	Figure	Surface Only	Surface and Core	Tributary Sample	Possible Background Location	Number of Sediment Samples	Lat	Long	Comment
LHR-001	684257	599897	1	0.2	A-1		X		X	2			Lower Background
LHR-002	685545	599368	1	0.25	A-1		X		X	2			Lower Background
LHR-003	684944	600927	1	0.4	A-1		X		X	2			Lower Background
LHR-004	686563	599925	1	0.45	A-1		X		X	2			Lower Background
LHR-005	684652	601812	1	0.45	A-1		X		X	2			Lower Background
LHR-006	686670	600741	1	0.6	A-1		X			2			
LHR-007	687121	602893	1	0.9	A-1		X			2			
LHR-008	687705	603366	2	1.1	A-2		X			2			Wetland Adjacent
LHR-009	688229	603503	2	1.2	A-2		X			2			Wetland Adjacent
LHR-010	690110	603928	2	1.55	A-2		X			2			BRIDGE
LHR-011	690667	602769	2	1.6	A-2		X			2			
LHR-012	690601	604039	2	1.65	A-2		X	X		2			Un-Named Tributary
LHR-013	691178	602897	2	1.7	A-2		X			2			
LHR-014	690995	603998	2	1.7	A-2		X			2			Wetland Adjacent
LHR-015	691431	604162	2	1.75	A-2		X			2			
LHR-016	691713	604327	2	1.8	A-2		X			2			
LHR-017	692088	603247	2	1.8	A-2		X			2			
LHR-018	693135	605199	3	2.2	A-3		X			2			BRIDGE
LHR-019	693593	605698	3	2.3	A-3		X			2			
LHR-020	694463	605158	3	2.3	A-3		X			2			
LHR-021	694900	606367	3	2.6	A-3		X			2			
LHR-022	694592	607630	3	2.75	A-3		X			2			BRIDGE
LHR-023	697376	609620	4	3.45	A-4		X			2			Point Bar
LHR-024	697795	610118	4	3.5	A-4		X			2			Power Plant
LHR-025	698533	609650	4	3.6	A-4		X			2			
LHR-026	699127	609183	4	3.75	A-4		X	X		2			Penhorn Creek
LHR-027	697726	608454	4	3.8	A-4		X			2			
LHR-028	698983	607103	5	4.1	A-5		X			2			
LHR-029	697532	606832	5	4.15	A-5		X			2			
LHR-030	697513	605447	5	4.4	A-5		X			2			
LHR-031	698455	605303	5	4.45	A-5		X			2			Wetland Adjacent
LHR-032	698365	604245	5	4.6	A-5		X			2			
LHR-033	699324	604633	5	4.7	A-5		X			2			Wetland Adjacent
LHR-034	699181	603901	5	4.7	A-5		X			2			BRIDGE
LHR-035	699591	603857	5	4.75	A-5		X			2			BRIDGE
LHR-036	700297	604776	5	4.9	A-5		x			2			Wetland Adjacent
LHR-037	701098	604216	6	5.1	A-6		X			2			BRIDGE
LHR-038	701656	605318	6	5.2	A-6		X			2			
LHR-039	702022	604753	6	5.2	A-6		X			2			Wetland Adjacent
LHR-040	702933	605364	6	5.4	A-6		X	X		2			Sawmill Creek

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Sample Station GPS Coordinates

Sample ID	NJ-SPF Northing	NJ-SPF Easting	River Mile	Station	Figure	Surface Only	Surface and Core	Tributary Sample	Possible Background Location	Number of Sediment Samples	Lat	Long	Comment
LHR-041	702647	605953	6	5.4	A-6		X			2			
LHR-042	703039	605613	6	5.45	A-6		X			2			Wetland Adjacent
LHR-043	703592	605820	6	5.6	A-6		X			2			Wetland Adjacent
LHR-044	703965	606603	6	5.7	A-6		X			2			Wetland Adjacent
LHR-045	704423	605807	6	5.75	A-6		X			2			
LHR-046	704862	606727	6	5.8	A-6		X			2			Wetland Adjacent
LHR-047	705026	605634	6	5.9	A-6		X			2			Wetland Adjacent
LHR-048	705744	605540	7	6.05	A-7		X			2			Wetland Adjacent
LHR-049	706159	606496	7	6.15	A-7		X			2			Wetland Adjacent
LHR-050	707050	606146	7	6.25	A-7		X			2			
LHR-051	707465	605225	7	6.35	A-7		X	X		2			Kingsland Creek
LHR-052	707689	605321	7	6.4	A-7		X			2			Wetland Adjacent
LHR-053	707940	605916	7	6.45	A-7		X			2			BRIDGE
LHR-054	708518	605315	7	6.6	A-7		X			2			BRIDGE/Wetland Adjacent
LHR-055	710160	605853	7	6.8	A-7		X	X		2			Mary Ann Creek
LHR-056	709590	606625	7	6.8	A-7		X			2			Wetland Adjacent
LHR-057	710507	606211	7	6.9	A-7		X			2			Wetland Adjacent
LHR-058	710303	607213	8	7.05	A-8		X			2			Wetland Adjacent
LHR-059	711906	607127	8	7.25	A-8		X	X		2			Berry's Creek
LHR-060	712358	608802	8	7.55	A-8		X			2			TIDAL FLAT
LHR-061	713230	608013	8	7.55	A-8		X			2			
LHR-062	712936	609104	8	7.6	A-8		X			2			TIDAL FLAT
LHR-063	713611	609701	8	7.8	A-8		X			2			TIDAL FLAT
LHR-064	714333	609611	8	7.9	A-8		X			2			TIDAL FLAT
LHR-065	715189	608800	8	7.95	A-8		X			2			
LHR-066	714097	610620	8	7.95	A-8		X			2			BACKWATER TIDAL FLAT
LHR-067	715720	609502	9	8.1	A-9		X			2			TIDAL FLAT
LHR-068	715969	609675	9	8.15	A-9		X	X		2			Berry's Creek Canal
LHR-069	716636	611535	9	8.6	A-9		X			2			Wetland Adjacent/Between BRIDGES
LHR-070	716963	612487	9	8.75	A-9		X			2			TIDAL FLAT
LHR-071	717908	612041	9	8.8	A-9		X			2			TIDAL FLAT/Wetland Adjacent
LHR-072	717699	612997	9	8.9	A-9		X			2			TIDAL FLAT
LHR-073	718534	612807	9	8.95	A-9		X			2			TIDAL FLAT/Wetland Adjacent
LHR-074	719132	614225	10	9.25	A-10		X			2			TIDAL FLAT
LHR-075	718553	614509	10	9.25	A-10		X			2			TIDAL FLAT
LHR-076	719474	615327	10	9.45	A-10		X			2			Old Bashes Creek Discharge Backwater/Wetland
LHR-077	718640	615671	10	9.5	A-10		X			2			TIDAL FLAT/Backwater Area
LHR-078	719480	615600	10	9.55	A-10		X	X		2			Bashes Creek
LHR-079	719479	615950	10	9.6	A-10		X			2			Wetland Adjacent
LHR-080	719550	616491	10	9.7	A-10		X	X		2			Moonachie Creek

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Sample ID	NJ-SPF Northing	NJ-SPF Easting	River Mile	Station	Figure	Surface Only	Surface and Core	Tributary Sample	Possible Background Location	Number of Sediment Samples	Lat	Long	Comment
LHR-081	719641	617047	10	9.8	A-10		X			2			Wetland Adjacent
LHR-082	719115	617169	10	9.8	A-10		X			2			TIDAL FLAT/Wetland Adjacent
LHR-083	719864	617819	10	9.95	A-10		X			2			Wetland Adjacent
LHR-084	719099	617943	10	9.95	A-10		X			2			TIDAL FLAT/Wetland Adjacent
LHR-085	719045	618553	11	10.1	A-11		X	X		2			Mill Creek
LHR-086	719148	618804	11	10.15	A-11		X			2			TIDAL FLAT/Wetland Adjacent
LHR-087	719875	619112	11	10.2	A-11		X			2			TIDAL FLAT/Wetland Adjacent
LHR-088	718976	619224	11	10.2	A-11		X	X		2			Cromakill Creek
LHR-089	719897	620563	11	10.5	A-11		X			2			TIDAL FLAT/Wetland Adjacent
LHR-090	720347	621013	11	10.6	A-11		X			2			TIDAL FLAT/Wetland Adjacent
LHR-091	721174	621275	11	10.75	A-11		X			2			TIDAL FLAT/Wetland Adjacent
LHR-092	721103	621944	11	10.8	A-11		X			2			Wetland Adjacent
LHR-093	721361	622175	11	10.85	A-11		X	X		2			Bellmans Creek
LHR-094	721965	621459	11	10.95	A-11		X	X		2			Un-Named Tributary
LHR-095	722495	622443	12	11.1	A-12		X			2			
LHR-096	722590	621807	12	11.15	A-12		X			2			TIDAL FLAT
LHR-097	722820	621706	12	11.2	A-12		X	X		2			Doctors Creek
LHR-098	723489	621532	12	11.3	A-12		X			2			TIDAL FLAT/Wetland Adjacent
LHR-099	723945	622038	12	11.35	A-12		X			2			TIDAL FLAT/Wetland Adjacent
LHR-100	723891	621472	12	11.4	A-12		X			2			TIDAL FLAT/Wetland Adjacent
LHR-101	724520	620876	12	11.55	A-12		X			2			TIDAL FLAT/Wetland Adjacent/BRIDGE
LHR-102	725008	621293	12	11.6	A-12		X			2			TIDAL FLAT/Wetland Adjacent
LHR-103	725007	620720	12	11.65	A-12		X			2			Wetland Adjacent/BRIDGE
LHR-104	725583	621035	12	11.7	A-12		X			2			TIDAL FLAT/Wetland Adjacent
LHR-105	726201	620291	12	11.8	A-12		X			2			TIDAL FLAT/Wetland Adjacent
LHR-106	726471	621005	12	11.85	A-12		X			2			TIDAL FLAT/Wetland Adjacent
LHR-107	726752	620387	12	11.9	A-12		X			2			TIDAL FLAT/Wetland Adjacent
LHR-108	727035	620292	12	11.95	A-12		X	X		2			Losen Slofe Creek
LHR-109	727338	620582	13	12.1	A-13		X			2			TIDAL FLAT/Wetland Adjacent
LHR-110	729117	622047	13	12.5	A-13		X			2			WASTEWATER TREATMENT PLANT
LHR-111	729404	622633	13	12.55	A-13		X			2			TIDAL FLAT/Wetland Adjacent
LHR-112	729645	621861	13	12.6	A-13		X			2			
LHR-113	729798	622359	13	12.6	A-13		X			2			Power Plant DRAIN/Wetland Adjacent
LHR-114	730933	622079	13	12.8	A-13		X			2			TIDAL FLAT
LHR-115	731275	621658	13	12.9	A-13		X			2			TIDAL FLAT/ DRAIN
LHR-116	731485	622270	13	12.9	A-13		X			2			TIDAL FLAT
LHR-117	731445	624378	13	12.9	A-13		X	X	X	2			Background Sample Overpeck Creek
LHR-118	732079	622418	14	13.15	A-14		X			2			TIDAL FLAT
LHR-119	732067	623339	14	13.15	A-14		X	X	X	2			Background Overpeck Creek South
LHR-120	732526	623493	14	13.2	A-14		X	X	X	2			Background Overpeck Creek North

Table 3-1
Lower Hackensack River Site Inspection
Sample Station GPS Coordinates

Sample ID	NJ-SPF Northing	NJ-SPF Easting	River Mile	Station	Figure	Surface Only	Surface and Core	Tributary Sample	Possible Background Location	Number of Sediment Samples	Lat	Long	Comment
LHR-121	732873	622447	14	13.25	A-14		X			2			TIDAL FLAT POINT BAR
LHR-122	732967	623076	14	13.3	A-14		X	X	X	2			Background Overpeck Creek by Bridge
LHR-123	733345	621714	14	13.35	A-14		X			2			BACKWATER TIDAL FLAT
LHR-124	733358	622238	14	13.35	A-14		X			2			TIDAL FLAT POINT BAR/ BRIDGE
LHR-125	733753	621746	14	13.4	A-14		X			2			TIDAL FLAT
LHR-126	733741	622223	14	13.4	A-14		X	X		2			Overpeck Creek
LHR-127	734765	622295	14	13.65	A-14		X			2			TIDAL FLAT
LHR-128	734979	622130	14	13.7	A-14		X			2			TIDAL FLAT/BRIDGE
LHR-129	735741	622290	14	13.75	A-14		X			2			POINT BAR
LHR-130	736081	622605	14	13.8	A-14		X			2			TIDAL FLAT
LHR-131	736588	622291	15	13.95	A-15		X			2			TIDAL FLAT
LHR-132	736771	622601	15	14	A-15		X			2			TIDAL FLAT
LHR-133	737302	622228	15	14.15	A-15		X			2			TIDAL FLAT
LHR-134	737609	621956	15	14.2	A-15		X			2			TIDAL FLAT
LHR-135	738107	621607	15	14.3	A-15		X			2			TIDAL FLAT/DRAIN
LHR-136	738720	621143	15	14.4	A-15		X			2			TIDAL FLAT
LHR-137	739644	621477	15	14.6	A-15		X			2			TIDAL FLAT
LHR-138	740116	620875	15	14.7	A-15		X			2			TIDAL FLAT
LHR-139	740383	621072	15	14.75	A-15		X			2			TIDAL FLAT
LHR-140	740604	620546	15	14.8	A-15		X			2			TIDAL FLAT
LHR-141	740888	620749	15	14.85	A-15		X			2			TIDAL FLAT/BRIDGE
LHR-142	741444	620339	15	15	A-15		X			2			TIDAL FLAT/BRIDGE
LHR-143	742171	620611	16	15.15	A-16		X			2			TIDAL FLAT
LHR-144	743097	620336	16	15.25	A-16		X			2			TIDAL FLAT/DRAIN (Gas Works Creek)
LHR-145	743771	620505	16	15.4	A-16		X			2			TIDAL FLAT
LHR-146	744428	620645	16	15.6	A-16		X			2			TIDAL FLAT/POINT BAR
LHR-147	744960	619828	16	15.8	A-16		X			2			POINT BAR
LHR-148	744841	619452	16	15.85	A-16		X			2			TIDAL FLAT
LHR-149	745135	619531	16	15.9	A-16		X			2			POINT BAR/BRIDGE
LHR-150	746520	620484	17	16.2	A-17		X			2			BRIDGE
LHR-151	746706	620622	17	16.25	A-17		X			2			BRIDGE
LHR-152	747105	620525	17	16.3	A-17		X			2			TIDAL FLAT / BALL PARKS
LHR-153	747469	620678	17	16.35	A-17		X			2			TIDAL FLAT / BALL PARKS
LHR-154	747463	621070	17	16.4	A-17		X			2			TIDAL FLAT
LHR-155	747934	620983	17	16.5	A-17		X			2			TIDAL FLAT
LHR-156	748463	621285	17	16.65	A-17		X			2			TIDAL FLAT/ REVERSE FLOW AREA
LHR-157	748793	621138	17	16.7	A-17		X			2			TIDAL FLAT/ REVERSE FLOW AREA
LHR-158	748751	620841	17	16.75	A-17		X			2			TIDAL ISLAND/ REVERSE FLOW AREA
LHR-159	748889	620378	17	16.8	A-17		X			2			TIDAL FLAT/POINT BAR
LHR-160	749675	620298	17	16.95	A-17		X			2			TIDAL FLAT

Table 3-1
Lower Hackensack River Site Inspection
Sample Station GPS Coordinates

Sample ID	NJ-SPF Northing	NJ-SPF Easting	River Mile	Station	Figure	Surface Only	Surface and Core	Tributary Sample	Possible Background Location	Number of Sediment Samples	Lat	Long	Comment
LHR-161	750278	620616	18	17.1	A-18		X			2			BRIDGE/BACKWATER AREA
LHR-162	750954	621197	18	17.25	A-18		X			2			
LHR-163	751134	621043	18	17.25	A-18		X	X		2			UN-NAMED TRIBUTARY
LHR-164	751561	621513	18	17.4	A-18		X			2			TIDAL FLAT
LHR-165	752755	621651	18	17.65	A-18		X			2			FOOT BRIDGE
LHR-166	753459	621661	18	17.8	A-18		X			2			TIDAL FLAT/POINT BAR
LHR-167	754007	621822	18	17.85	A-18		X			2			BACKWATER/BRIDGE
LHR-168	754199	622258	19	18	A-19		X			2			TIDAL FLAT/POINT BAR
LHR-169	754670	622922	19	18.2	A-19		X			2			TIDAL FLAT/BACKWATER AREA
LHR-170	755161	622930	19	18.25	A-19		X			2			INDIAN POND
LHR-171	756049	623475	19	18.45	A-19		X			2			TIDAL ISLAND/ REVERSE FLOW AREA
LHR-172	756626	623029	19	18.6	A-19		X			2			TIDAL FLAT/BACKWATER AREA
LHR-173	756686	623380	19	18.6	A-19		X			2			TIDAL FLAT/ REVERSE FLOW AREA
LHR-174	756991	623162	19	18.65	A-19		X			2			TIDAL ISLAND/ REVERSE FLOW AREA
LHR-175	757238	622773	19	18.75	A-19		X			2			TIDAL FLAT
LHR-176	7579220	622803	19	18.85	A-19		X			2			TIDAL FLAT/BACKWATER AREA
LHR-177	757905	622021	19	18.95	A-19		X	X		2			Van Saun Mill Brook
LHR-178	758359	621837	20	19.1	A-20		X			2			TIDAL FLAT/BACKWATER AREA
LHR-179	758394	622014	20	19.1	A-20		X	X		2			French Brook
LHR-180	759064	621645	20	19.2	A-20		X			2			TIDAL FLAT
LHR-181	761575	621304	20	19.75	A-20	X				1			BACKWATER DEPOSIT
LHR-182	763109	622064	21	20.2	A-21	X				1			BACKWATER AREA
LHR-183	766032	622459	21	20.8	A-21	X				1			BACKWATER/TIDAL FLAT
LHR-184	767773	623191	22	21.25	A-22	X				1			BACKWATER DOWNSTREAM OF POINT
LHR-185	769781	622945	22	21.75	A-22	X				1			BYPASS DAM OVERFLOW/BACKWATER AREA
LHR-186	770281	623933	23	22.15	A-23	X		X		1			Hirshfeld Brook (Surface Only)
LHR-187	770570	623401	23	22.25	A-23		X		X	2			Background POINT BAR
LHR-188	770921	623195	23	22.3	A-23		X		X	2			Background POINT BAR
LHR-189	770807	622940	23	22.35	A-23		X		X	2			Background DOWNSTREAM OF DAM
LHR-190	771000	622803	23	22.4	A-23		X		X	2			Background DOWNSTREAM OF DAM

Tributary = 24 Total = 374

Table 4-1
Sample Containers, Preservation, and Holding Times
Lower Hackensack River Site Inspection

Matrix	Analytical Group	Analytical / Preparation Method SOP Reference ¹	Containers	Sample volume ³	Preservation Requirements	Analytical Holding Time ²	Data Package Turnaround Time ⁴
			(number, size, and type)	(units)		(preparation / analysis)	
Sediment	TAL Metals	CLP ISM02.3	(1) 8 oz. glass jar w/Teflon lined cap	Fill to Capacity	Cool to 4°C	180 days (except Hg 28 days)	42 days
Sediment	SVOCs	CLP SOM02.3	(1) 8 oz. glass jar w/Teflon lined cap	150 grams	Cool to 4°C	14 days / 40 days	42 days
Sediment	PCBs	CLP SOM02.3	(1) 8 oz. glass jar w/Teflon lined cap	150 grams ⁵	Cool to 4°C	14 days / 40 days	42 days
Sediment	TOC	DESA SOP C-88	(1) 4 oz. glass jar with Teflon lined cap	100 grams	Cool to 4°C	None	42 days
Sediment	Grain Size	DESA SOP BIO 8.2	(1) 4 oz. glass jar with Teflon lined cap	250 grams	Cool to 4°C	None	42 days
Water (Rinsate)	TCL Metals	CLP ISM02.3	1 L HDPE bottle	1 L	Cool to 4°C, HNO ₃ <2 pH	180 days for metals except Hg, 28 days	42 days
Water (Rinsate)	SVOCs	CLP SOM02.3	(2) 1 L amber round glass bottle w/Teflon lined cap	2 L	Cool to 4°C	7 days / 40 days	42 days
Water (Rinsate)	PCBs	CLP SOM02.3	(2) 1 L amber round glass bottle w/Teflon lined cap	2 L	Cool to 4°C	7 days / 40 days	42 days

Notes:

- ¹ Refer to the Analytical SOP References table (Worksheet #23).
- ² Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.
- ³ The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for the laboratory MS/MSD sample analysis.
- ⁴ 21 day turnaround time for laboratory results plus 21-day turnaround time for data validation.

Project-Specific FSP

Site Name/Project Name: Lower Hackensack River Site Inspection

Site Location: Bergen and Hudson Counties, NJ

Revision Number: 002

Date: June 1, 2016

Attachments

Project-Specific FSP

Site Name/Project Name: Lower Hackensack River Site Inspection

Site Location: Bergen and Hudson Counties, NJ

Revision Number: 002

Date: June 1, 2016

Attachment A

Lower Hackensack River Sample Stations by River Mile (Infrared Aerial Photography)

Project-Specific FSP

Site Name/Project Name: Lower Hackensack River Site Inspection

Site Location: Bergen and Hudson Counties, NJ

Revision Number: 002

Date: June 1, 2016

Attachment B

Lower Hackensack River Sample Stations by River Mile (Bathymetric Survey)

Project-Specific FSP

Site Name/Project Name: Lower Hackensack River Site Inspection

Site Location: Bergen and Hudson Counties, NJ

Revision Number: 002

Date: June 1, 2016

Attachment C

Lower Hackensack River Sample Stations by River Mile (NOAA Navigational Charts)

Project-Specific FSP

Site Name/Project Name: Lower Hackensack River Site Inspection

Site Location: Bergen and Hudson Counties, NJ

Revision Number: 002

Date: June 1, 2016

Attachment D

Lower Hackensack River Marine Utilities

Project-Specific FSP

Site Name/Project Name: Lower Hackensack River Site Inspection

Site Location: Bergen and Hudson Counties, NJ

Revision Number: 002

Date: June 1, 2016

Attachment E

Field Sample Forms